
Space Weather Technical Forecast

Issued on Sunday, 28 January 2024 at 01:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Chance of G1 Minor Storms either late on 29 or 30 January due to the onset of a high speed stream. Chance of isolated M-flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with only low-level C-class flares observed. There are three numbered regions on the visible disc, with AR3559 in the northwest quadrant the most dominant region. This however has weakened through the last 24 hours and is less magnetically complex. In contrast, AR3560 appears to be developing after being largely dormant and will continue to be monitored. AR3563 had previously developed into a weak unipolar spot, but has since started to fade. No Earth-directed CMEs were observed with two CMEs observed emanating from the far side of the Sun.

Solar Wind / Geomagnetic Activity: Solar winds have not shown evidence of any CME arrivals, with a decline from slightly elevated to ambient speeds and below average density observed. Total magnetic field strength, Bt was weak, with the north-south component, Bz also oscillating weakly. Phi angle was mainly positive (away from the Sun) with a brief switch into the negative sector between 27/1600UTC and 27/1800UTC. Geomagnetic activity was mainly Quiet, with one Unsettled interval.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background. GOES16 high energy (greater than 2MeV) electron flux was at background. The associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold on a steady trend. At 28/0000UTC the 24-hour integrated fluence observation was 1.18e6 integrated pfu.

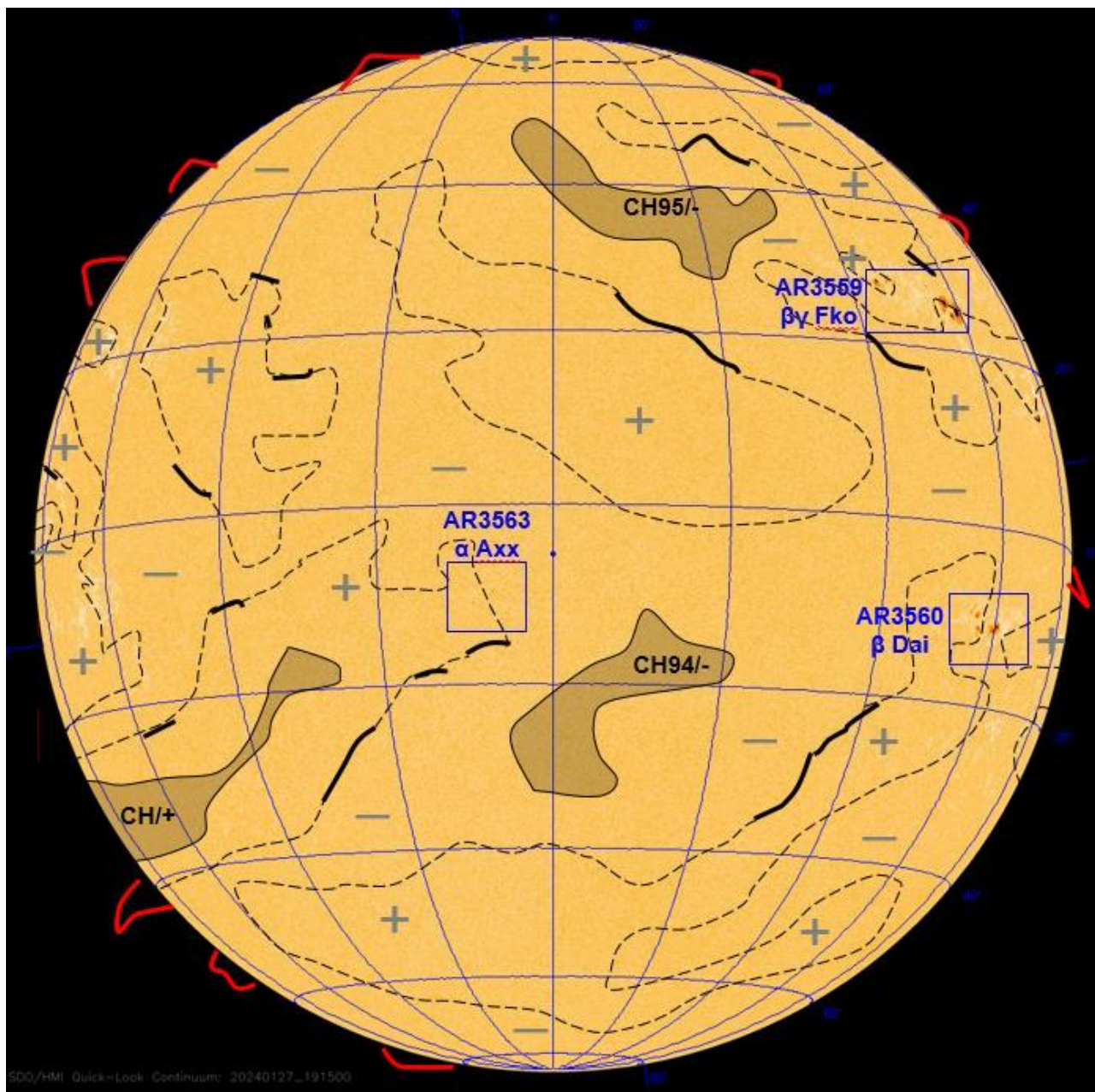
Four-Day Space Weather Forecast Summary

Solar Activity: Mainly Low activity forecast, with isolated M-class flares possible.

Solar Wind / Geomagnetic Activity: A series of CMEs that were forecast to affect the Earth on 27 January are now assumed to have missed the Earth, with no further CMEs forecast. Solar wind speeds are forecast to increase from background values to reach between 400-500km/s either late on 29 or into 30 January due to a connection to coronal hole 94. Geomagnetic activity is forecast to be mainly Quiet, but may reach Active or G1/Minor Storm levels due to the onset of the coronal hole high speed stream.

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background with only a slight chance of rising to in response to any notable flares from the sunspots nearing the west limb. High energy electron flux (greater than 2MeV) is expected to persist at mainly background until at least 30 January, when an increase is then possible following the onset of any fast winds. The associated electron fluence is forecast to remain well below the Active threshold.

Figure 1. Solar Analysis Valid 27/2000UTC.



Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/- , Coronal Holes: Grey shaded area CHxx +/- , Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No Earth directed CMEs are forecast, with a series of CMEs forecast for 27 January now likely to have missed the Earth.

Solar winds are at background, with the next enhancement expected from coronal hole 94 either late on 29 or during 30 January. Solar wind speeds from this feature reached 500km/s on the last rotation, with similar or slightly higher speeds forecast on this rotation. This is due to the slightly stronger appearance of the coronal hole. As this is a negative coronal hole, a stronger response is increasingly favoured approaching the March equinox, but this effect is likely to be limited at this time of year. The coronal hole is a recurrent feature, with a risk of a CIR (co-rotating interaction region) ahead of the coronal hole high speed stream connection which could enhance any response during the onset of the high speed stream. Coronal hole 95 is expected to be too far north to affect the Earth.

Mainly Quiet geomagnetic activity is expected in the absence of any CME arrivals. The high speed stream connection either late on 29 or during 30 January may result in Unsettled to Active intervals, with a chance of G1/Minor storms during the initial connection of the high speed stream.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	20	40	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: L1 solar wind observations



Radio Blackouts - X-Ray Flares:

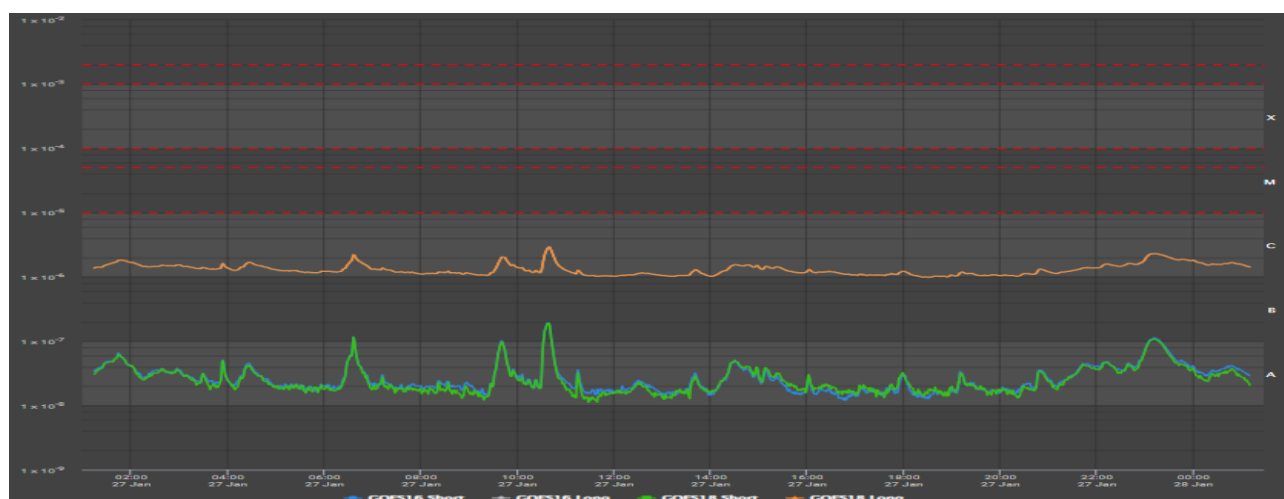
Low activity is forecast with a chance of isolated M-class flares, mainly from AR3559 which is approaching the northwest limb.

Ex-AR3561 which is now beyond the western limb, was responsible for much of the recent activity, and still presents a limited risk due to any flares which are elevated above the limb. The risk of M-class flares is then expected to decline as this region continues to rotate onto the far side. AR3559, which has simplified through the last few days, continues to present an elevated flare risk. There is also a risk of significant active regions rotating across the eastern limb through the forecast period, evidenced by two large far-sided CME during 27 January. The only notable region on the disc, AR3560 has grown notably, but is not yet considered to present a significant flare risk.

The balance of departing regions and potential emergence, leads to a steady forecast of a chance of further M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES 16 X-ray flare activity



Solar Radiation Storms - (High Energy Protons):

GOES18 high energy (greater than 10MeV) proton flux is at background. Despite AR3559 showing signs of weakening, there remains a slight chance of any notable flares increasing the observed flux at Earth, with a very slight and reducing chance of reaching the S1/Minor Radiation storm level.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	5	5	2	2
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

High Energy Electrons Event ($\geq 2\text{MeV}$):

The high energy electron flux (greater than 2MeV) is expected to remain at background levels during much of the forecast period, with no CME enhancements expected. A high speed stream connection, forecast for either late on 29 January or during 30 January may contribute to the radiation belts and lead to an upward trend in electron flux values. Values may then reach high levels on diurnal highs by the end of the period.

Electron fluence values may begin to also trend upwards towards the end of the forecast period due to the anticipated increase in electron flux values. However these are unlikely to exceed the Active ($1\text{e}8$ integrated pfu) threshold.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	1
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1